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Title of the Invention: Covering for Excreta Deposits

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[SCOPE OF CLAIM FOR PATENT]

[CLAIM 1]

An excreta deposit covering that covers the surface of the excreta deposits of livestock deposited on the ground for drying and fermenting those excreta deposits comprising a porous cloth or a laminate of porous polyolefin film and porous cloth having water vapor permeability of 1500 g/m<sup>2</sup>-24 hours or more, water resistant pressure of 0.1 kgf/cm<sup>2</sup> or more, and air permeability of 3000 seconds/100 cc or less.

[CLAIM 2]

An excreta deposit covering as set forth in claim 1 wherein said porous cloth is selected from among split cloth, non-woven cloth, woven cloth or mesh having a fabric density within the range of 10-500 g/m<sup>2</sup>.

[CLAIM 3]

An excreta deposit covering as set forth in claim 1 wherein said porous polyolefin film has for its raw material a resin composition comprised of (A) 100 parts by weight of polyolefin resin having a density of 0.93 g/cm<sup>3</sup> or less and melt index of 2 g/10 min or less, (B) 25-400 parts by weight of filler, (C) 0.1-10.0 parts by weight of hindered amine light stabilizer, and (D) 0.1-10.0 parts by weight of ultraviolet absorber selected from the group consisting of benzotriazole, benzophenone and benzoate ultraviolet absorbers, and is produced by drawing in at least the uniaxial direction.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Technical Field of the Invention]

The present invention relates to an excreta deposit covering, and more particularly, to a covering used for the purpose of drying and fermenting excreta excreted by livestock including milking cows, beef cattle, sheep, goats, horses and pigs.

[0002]

[Prior Art]

Although varying according to the amount, the majority of excreta excreted by livestock such as milking cows, beef cattle, sheep, goats, horses and pigs on large-scale livestock farms in the past employed any of several methods consisting of, for example, (1) depositing in a concrete frame located next to the barn, (2) transporting to a lagoon by buckets from the side of the barn, (3) transporting by pipeline from the barn, (4) transporting to an underground slurry tank by pipeline from the barn, (5) transporting to a manure shed by buckets from the side of the barn, (6) separating solids and liquids by machinery, and (7) depositing in a large paddock. The solid component obtained in methods (1) through (7) is used as compost, while the liquid component is used as liquid fertilizer.

[0003]

Although it is necessary to reduce the liquid component and sufficiently ferment lining materials such as oaten pipes and rice straw in order to commercialize the solid component as compost, it is difficult to achieve sufficient fermentation with methods (1) through (7) above. In addition, in the case of the above-mentioned methods (1) through (3), since the location where the excreta is deposited has no roof and is open to the outside, various problems result including problems caused by foul odors resulting from odors dissipating to surrounding areas, contamination of ground water resulting from rain water entering

the location where the excreta is deposited and causing the juice to run off and accumulate on the surface of the ground, water pollution resulting from the runoff juice flowing into rivers and lakes, and eutrophication.

[0004]

In the case of the methods of (4) and (5) above, although there are no problems resulting from dissipation of foul odors or runoff of juice caused by the entrance of rain since a roof is provided, in addition to considerable costs being incurred as a result of requiring a large building site and having to build a structure, the problem of dissipation of foul odors is still not solved. In the case of the above-mentioned method (6), in addition to machinery for separating solid and liquid components being expensive, there are the problems of converting the solid component to compost and processing the large amount of liquid produced. In the case of the above-mentioned method (7), although significant costs are not required since a structure is not built, there is the problem of dissipation of foul odors and environmental problems such as runoff of juice caused by entrance of rainwater.

[0005]

[Problems to be Solved by the Invention]

As a result of the inventors of the present invention conducting earnest research on a method to solve the above-mentioned problems in consideration of the current state of processing livestock excreta, it was found that covering the surface of excreta deposits deposited on the ground with a special covering that allows the permeation of water vapor and air but does not allow the permeation of moisture is effective, thereby leading to completion of the present invention. The object of the present invention is as follows:

1. to provide a covering that covers deposits of livestock excreta deposited in a paddock and so forth and promotes drying

by preventing the entrance of rainwater; and,  
2. to provide a covering that covers deposits of livestock excreta deposited in a paddock and so forth that is able to promote fermentation of lining materials such as oaten pipes and rice straw contained in excreta deposits.

[0006]

[Means for Solving the Problems]

In order to solve the above-mentioned problems, the present invention provides an excreta deposit covering that covers the surface of excreta deposits of livestock deposited on the ground for drying and fermenting those excreta deposits comprising a porous cloth or a laminate of porous polyolefin film and porous cloth having water vapor permeability of  $1500 \text{ g/m}^2$ -24 hours or more, water resistant pressure of  $0.1 \text{ kgf/cm}^2$  or more, and air permeability of 3000 seconds/100 cc or less.

[0007]

[Preferred Mode for Carrying Out the Invention]

The following provides a detailed explanation of the present invention.

1. Porous Cloth

The porous cloth can itself be used alone as a covering for excreta deposits, and can also be used in the form of a laminate in which it is laminated with a porous polyolefin film to be described later. The porous cloth should have water vapor permeability of  $1500 \text{ g/m}^2$ -24 hours or more, water resistant pressure of  $0.1 \text{ kgf/cm}^2$  or more, and air permeability of 3000 seconds/100 cc or less, examples of which include split cloth fabricated from split cloth, non-woven cloth, woven cloth and mesh, with that having a fabric density of about  $10\text{-}500 \text{ g/cm}^2$  being preferable. Non-woven cloth is particularly preferable.

[0008]

It is necessary that the porous cloth be air permeable, water-vapor permeable and have elasticity, and in the case of

that laminated with porous polyolefin film to be described later, it must also having adhesiveness with this film. Examples of raw materials of this porous cloth include polyamide resin, polyester resin, Rayon and polyolefin resin. It is preferable that ultraviolet absorber, hindered amine light stabilizer, colorant or various other types of resin additives be blended into the raw material of the porous cloth in order to improve weather resistance, light resistance, durability and so forth.

[0009]

Non-woven cloth refers to that in which the fibers are formed into the form of a sheet regardless of whether it be by weaving or braiding, and examples of production methods of fiber sheets include a dry method, wet method and span bonding method. In the dry method, fibers having 1-10 cm in length are used, the fibers are formed into a thin sheet with a spinning card and so forth, and joined by needle punching (in which the fibers are intertwined by inserting a needle), stitch bonding (in which the cloth is sewn together with thread) or adhesion (using an adhesive for blends of heat-melted fibers). The resulting cloth has a high degree of bulkiness and resiliency.

[0010]

In the wet method, short fibers having a length of only several millimeters are dispersed in water and formed into a sheet using a paper machine and polyethylene resin fibers as binder. The resulting cloth appears in the manner of paper since it is also referred to as chemical fiber paper. In the span bonding method, chemical fibers are spun while drawing the fibers directly into the form of a sheet, and similar to non-woven cloth produced by the dry method in the method for producing non-woven cloth, in addition to the resulting cloth being bulky and soft, it also has excellent strength. Non-woven cloth may be produced by any of these methods. The non-woven fabric has a unit weight of 10-500 g/m<sup>2</sup>, and it is particularly preferable to select that

having a unit weight of 20-300 g/m<sup>2</sup>.

[0011]

Ultraviolet absorber that can be blended into the raw material resin for producing non-woven cloth is selected from the group consisting of benzotriazole, benzophenone and benzoate ultraviolet absorbers. Examples of benzotriazole ultraviolet absorbers include 2-(5-methyl-2-hydroxyphenyl)benzotriazole, 2-[2-hydroxy-3,5-bis( $\alpha$ , $\alpha$ -dimethylbenzyl)phenyl]-2H-benzotriazole, 2-(3,5-di-t-butyl-2-hydroxyphenyl)benzotriazole, 2-(3-t-butyl-5-methyl-2-hydroxyphenyl)-5-chlorobenzotriazole, 2-(3,5-di-t-amyl-2-hydroxyphenyl)benzotriazole and 2-(2'-hydroxy-5'-t-octylphenyl)benzotriazole.

[0012]

Examples of benzophenone ultraviolet absorbers include 2-hydroxy-4-n-octoxybenzophenone, 2,2'-dihydroxy-4-methoxybenzophenone, 2-hydroxy-4-methoxybenzophenone, p-t-butylphenylsalicylate-2-hydroxy-4-methoxybenzophenone and 2-(2-hydroxy-3,5-di-t-butylphenyl)benzotriazole. Examples of benzoate ultraviolet absorbers include 2,4-di-t-butylphenyl-3,5-di-t-butyl-4-hydroxybenzoate. In particular, 2-hydroxy-4-n-octoxybenzophenone is preferable.

[0013]

Examples of hindered amine light stabilizers that can be blended include Sanol LS-770, Sanol LS-262 and Sanon LS-765 (trade names, Sankyo), Tinuvin 144, Tinuvin 622, Tinuvin 622LD, Tinuvin 770 and Tinuvin 120 (trade names, Chiba-Geigy), Chimasorb 944FL, Chimasorb 944LD and Chimasorb 119FL (trade names, Chiba-Geigy), Adekastab LA-57, Adekastab LA-77, Adekastab LA-62, Adekastab LA-67, Adekastab LA-63, Adekastab LA-68, Adekastab LA-82 and Adekastab LA-87 (trade names, Asahi Denka Kogyo), Sumisorb TM-061 (trade name, Sumitomo Chemical), Cyasorb UV-

3346 (trade name, ACC) and Goodlite UV-3034 (trade name, Goodrich). Tinuvin 622, Tinuvin 622LD (dimethyl-1-(2-hydroxyethyl)-4-hydroxy-2,2,6,6-tetramethylpiperidine succinate condensation polymer), Chimasorb 944FL and Chimasorb 944LD (poly[{6-(1,1,3,3-tetramethylbutyl)amino-1,3,5-triazine-2,4-diyl} {(2,2,6,6-tetramethyl-4-piperidyl)imino} hexamethylene {(2,2,6,6-tetramethyl-4-piperidyl)imino}]) are particularly preferable.

[0014]

The amount of ultraviolet absorber blended into the raw material resin for production of non-woven cloth is preferably within the range of 0.01-5 parts by weight while the amount of hindered amino light stabilizer is preferably within the range of 0.01-5 parts by weight to 100 parts by weight of raw material resin. It is preferable to blend and mix the above compounds into the base resin prior to producing short fibers.

[0015]

Porous cloth may be water-proof (water-repellent), and examples of water-proofing agents used during water-proofing processing include insoluble aluminum soap, paraffin, wax and methylhydropolysiloxane as well as polymer compounds having a  $-CF_3$  group on the end of a pentane chain relative to the polymer chain, and surface activators having fluorocarbons for their hydrophobic groups. These compounds may be used alone or as a mixture of two or more types.

[0016]

## 2. Porous Polyolefin Film

The excreta deposit covering as claimed in the present invention may also be in the form of a laminate of the above-mentioned porous cloth and a porous polyolefin film. The porous polyolefin film preferably has for its raw material a resin composition comprised of (A) 100 parts by weight of polyolefin resin having a density of  $0.93 \text{ g/cm}^3$  or less and melt index of

2 g/10 min or less, (B) 25-400 parts by weight of filler, (C) 0.1-10.0 parts by weight of hindered amine light stabilizer, and (D) 0.1-10.0 parts by weight of ultraviolet absorber selected from the group consisting of benzotriazole, benzophenone and benzoate ultraviolet absorbers, and is preferably produced by drawing in at least the uniaxial direction.

[0017]

#### 2-1 Raw Material Resin Composition

Polyolefin resin (A) in the present invention (to be simply referred to as "resin (A)") refers to an ethylene or propylene homopolymer or copolymer with another monomer that can be polymerized with ethylene or propylene, specific examples of which include low-density polyethylene, linear low-density polyethylene, ethylene-vinyl acetate copolymer, ultra-low-density polyethylene, polypropylene, ethylene-propylene copolymer, ethylene-propylene-diene copolymer, ethylene-methacrylate ester copolymer or a mixture thereof having a density of 0.910 g/cm<sup>3</sup> or less.

[0018]

Linear, low-density polyethylene refers to a copolymer of ethylene and another  $\alpha$ -olefin. Examples of other copolymerizable  $\alpha$ -olefins include propylene, 1-butene, 1-pentene, 1-hexene, 1-octene, 1-decene and 4-methyl-1-pentene. These can also be copolymerized with unconjugated dienes such as 1,4-hexadiene, dicyclopentadiene and ethylidene norbornene. The amount of the other  $\alpha$ -olefin can be selected within the range of 4-17 percent by weight.

[0019]

It is necessary that the above-mentioned polyolefin resin (A) having a density of 0.930 g/cm<sup>3</sup> or less and melt index (MI) of 2 g/10 minutes or less. When polyolefin resin (A) is a mixture of a plurality of types having different densities, its density



refers to the weighted average of the density of its composite components. It is preferable that polyolefin resin (A) be a mixture composed of 50-100 parts by weight of linear, low-density polyethylene having a density of 0.910-0.950 g/cm<sup>3</sup>, and 50-0 parts by weight of ethylene- $\alpha$ -olefin copolymer having a density of less than 0.91 g/cm<sup>3</sup>. Here, melt index (MI) refers to the value measured in compliance with condition 4 in Table 1 of JIS K-7210, the standard cited in JIS K-6760.

[0020]

The density ( $\rho$ ) of polyolefin resin (A) is 0.93 g/cm<sup>3</sup> or less. If density ( $\rho$ ) is greater than 0.93 g/cm<sup>3</sup>, the synergistic effects of the plasticizer and radical generator are reduced thereby preventing improvement of tear strength. In addition, if melt index (MI) is greater than 2 g/10 minutes, the tear strength of the film is reduced and molding stability decreases.

[0021]

The filler (B) blended into polyolefin resin (A) may be either an inorganic filler or organic filler. Examples of inorganic fillers include calcium carbonate, talc, clay, kaolin, silica, diatomaceous earth, magnesium carbonate, barium carbonate, magnesium sulfate, barium sulfate, calcium sulfate, aluminum hydroxide, zinc oxide, magnesium hydroxide, calcium oxide, magnesium oxide, titanium oxide, alumina, mica, asbestos powder, glass powder, silas balloon, zeolite and silica clay. Calcium carbonate, talc, clay, silica, diatomaceous earth and barium sulfate are particularly preferable.

[0022]

Examples of organic fillers include wood chips, pulp powder and other cellulose powders. They may be used alone or in the form of a mixture. The mean particle size of the filler is preferably 30  $\mu$ m or less, with a particle size of 0.7-5  $\mu$ m being particularly preferable. If the particle size is excessively

large, the fineness of the pores in the drawn product becomes poor, and if the particle size is too small, dispersion in the resin becomes poor resulting in inferior moldability.

[0023]

From the viewpoints of dispersivity in resin (A) and the drawability of resin (A), it is preferable that the above-mentioned filler (B) be subjected to surface treatment by a surface treatment agent. Examples of surface treatment agents include fatty acids or their metal salts.

[0024]

Hindered amine light stabilizer (C) and ultraviolet absorber (D) blended into polyolefin resin (A) can be blended into the raw material resin during production of the above-mentioned non-woven cloth, and can be suitably selected from the examples of compounds indicated.

[0025]

In addition to the above-mentioned components, combined use of plasticizer (E) and radical generator (F) as necessary in polyolefin resin (A) is preferable since it improves the strength of the porous film and prevents the occurrence of tearing and breaking in the step of being laminated with the above-mentioned porous cloth. Plasticizer (E) has an ester bond or amide bond within its molecule, and a compound having a molecular weight of 100 or more is preferable. If the molecular weight is too low, the plasticizer rapidly bleeds from the film thereby making this undesirable. Plasticizer (E) has a boiling point at normal pressure of 200°C or less, and a compound having a melting point of 100°C or less is preferable. If the melting point exceeds 100°C, the effect of improving tear strength resulting from denaturation with the radical generator is reduced, and if the boiling point is lower than 200°C, moldability and drawability decrease due to smoking and bubbling during molding.

[0026]

Specific examples of plasticizer (E) that satisfy the above-mentioned physical properties include stearic amide, oleic amide, triisodecyltrimellitate, trioctyltrimellitate, diisodecylphthalate and dioctylphthalate. Particularly preferable examples include trioctyltrimellitate and diisodecylphthalate.

[0027]

Compounds for which the decomposition temperature for a half-life of one minute is within the range of 130-300°C are preferable for radical generator (F). Specific examples of radical generator (F) include peroxides such as dicumylperoxide, 2,5-dimethyl-2,5-di(t-butylperoxy)hexane, 2,5-dimethyl-2,5-bis(t-butylperoxy)-3-hexane,  $\alpha,\alpha$ -bis(t-butylperoxyisopropyl) benzene, dibenzoylperoxide and di-t-butylperoxido-2,5-dimethylhexane-2,5-dihydroperoxide. A particularly preferable example is 2,5-dimethyl-2,5-bis(t-butylperoxy)-3-hexane.

[0028]

In producing the raw material resin composition, 25-400 parts by weight of filler (B) and 0.1-10 parts by weight of hindered amine light stabilizer (C) and ultraviolet absorber (D) are blended with respect to 100 parts by weight of polyolefin resin (A). If the proportion of filler (B) is less than 25 parts by weight, pores are not adequately formed in the drawn film thereby lowering the degree of porosity. In addition, if the proportion of filler exceeds 400 parts by weight, kneadability, dispersivity and film moldability become inferior and the surface strength of the drawn film decreases, thereby making this undesirable.

[0029]

If the amount of hindered amine light stabilizer (C) and ultraviolet absorber (D) added is less than 0.1 parts by weight, weather resistance when using the product covering for a long

period of time becomes inadequate. In addition, if the added amount exceeds 10 parts by weight, bleeding following film molding becomes excessive, thereby making this undesirable in addition to the effect of improving durability also being diminished. Furthermore, the ratio of hindered amine light stabilizer (C) and ultraviolet absorber (D) is 1-50:50-1 and preferably 1-10:10-1.

[0030]

Although a drum or tumbler mixing machine, ribbon blender, Henschell mixer or super mixer may be used to mix the polyolefin resin, additives, plasticizer, radical generator and filler, a Henschell mixer or other type of high-speed agitation mixer is preferable, and the polyolefin should preferably be supplied in the form of a powder normally of a fineness of 10-150 mesh, and preferably 20-60 mesh. Kneading of the resulting mixture can be performed using a commonly known kneading apparatus such as a screw extruding machine, double screw extruding machine, mixing roller, banbury mixer and double screw kneading machine.

[0031]

## 2-2 Production of Porous Polyolefin Film

In producing the porous polyolefin film, polyolefin resin (A), filler (B), hindered amine light stabilizer (C), ultraviolet absorber (D), and as necessary, plasticizer (E) and radical generator (F), are blended and mixed in the above-mentioned weight ratios followed by, if necessary, the blending of colorant, antistatic agent, fluorescent material and so forth. Next, after melting and kneading to form pellets, the pellets are molded by inflation to form a non-oriented film.

[0032]

When polyolefin resin (A) is kneaded and treated with radical generator (F) while heating (preferably at a temperature equal to or higher than the temperature at which the half-life of the radical generator is 10 minutes) in accordance with the method

described above, a crosslinking reaction occurs due to the radical generator causing coupling to occur between molecules of polyolefin resin (A) resulting in the obtaining of a denatured polymer in which the high molecular weight component is increased and the melt index is decreased. In comparison with the polymer prior to denaturing, this denatured polymer is easily oriented in the horizontal direction during inflation molding, and a film obtained in this manner is preferable as a result of having significantly improved tensile strength and impact strength in the case of being subjected to drawing treatment.

[0033]

The porous polyolefin film is normally produced by first producing a non-oriented film having a thickness of 10-200  $\mu\text{m}$  or non-oriented sheet having a thickness of 200-400  $\mu\text{m}$  by inflation molding or T-die molding from a resin composition produced according to the above-mentioned method, and then drawing this non-oriented film or sheet. In the case of using inflation molding, the blow-up ratio (BUR) is normally selected to be within the range of 2-8.

[0034]

Next, the non-oriented film or sheet produced by inflation molding is then uniaxially oriented in at least the vertical direction (direction in which the film is pulled). Although roller drawing is normally used when uniaxially orienting the non-oriented film or sheet, a method may also be employed in which the uniaxial direction (direction in which the film is pulled) is emphasized in tubular drawing. In addition, a single-stage drawing system or multi-stage drawing system of two or more stages may be used for drawing. In addition, in the case of non-oriented film produced by T-die molding as well, the film is uniaxially oriented at least in the vertical direction and if necessary, is drawn in the horizontal direction (direction perpendicular

to the direction in which the film is pulled).

[0035]

Although temperature conditions during drawing of the non-oriented film or sheet vary according to the type of raw material resin, types and amounts of additives, thickness of the film or sheet and so forth, the temperature is selected within the range of 20-100°C, and the drawing multiplying factor is selected within the range of 1.2-8 times for the vertical and horizontal directions, respectively. Furthermore, if heat treatment is performed following completion of the drawing step, the dimensional accuracy of the resulting porous polyolefin film can be stabilized. The porous polyolefin film obtained in this manner preferably has a thickness of 100  $\mu\text{m}$  or less, and particularly preferably within the range of 15-50  $\mu\text{m}$ .

[0036]

#### 2-3 Laminate

Examples of methods for laminating porous polyolefin film and porous cloth include (i) a method that uses adhesive, and (ii) a method that uses thermal adhesion. In the case of either method, the porous polyolefin film and porous cloth are preferably adhered so that their respective adhered surface areas are within the range of 5-60% of the opposing surface. If the adhered surface area is less than 5%, the portion of the resulting covering that is adhered at the time of use separates due to the small size of the adhered portion. If the adhered surface area exceeds 60%, the air permeability, water vapor permeability and flexibility of the covering decrease to the adhered surface area being excessively large, thereby making both of these cases undesirable.

[0037]

Although there are no particular restrictions on the method used to adhere the porous polyolefin film and porous cloth, in

the case of adhering using the above-mentioned adhesive method (i), a method that uses a hot melting adhesive or pressure-sensitive adhesive is preferable. Examples of hot melting adhesives that can be used at this time include polyamide, polyester or polyolefin resins, tape and webbing. An example of the thermal adhesion method of (ii) above, the surface of the porous film is heated and adhered by pressing onto the porous polyolefin film while heating and melting in the case of using a thermoplastic resin for the material of the cloth layer. The adhered surface preferably is in the form of lines, dots, lattice or random form.

[0038]

### 3. Physical Properties of Covering

The excrete deposit covering as claimed in the present invention requires a water vapor permeability of  $1500 \text{ g/m}^2\text{-24 hours}$  or more whether it consist of a porous cloth only or a laminate of a porous cloth and porous polyolefin film. Here, water vapor permeability refers to the value measured in compliance with JIS Z-0208. If the water vapor permeability is less than  $1500 \text{ g/m}^2\text{-24 hours}$ , water vapor that evaporates from the excreta deposit when the covering is used to cover an excrete deposit is unable to sufficiently pass through the covering and prevents the covering from sufficiently demonstrating its water vapor permeability function, thereby making this undesirable. Furthermore, the upper limit of water vapor permeability is about  $20,000 \text{ g/m}^2\text{-24 hours}$ , and if this upper limit is exceeded, although water vapor that evaporates from the excrete is able to sufficiently pass through the covering, it also becomes easier for rainwater and so forth to pass through the covering, thereby making this undesirable. A particularly preferable range of the degree of water vapor permeability is  $2500\text{-}10,000 \text{ g/m}^2\text{-24 hours}$ .

[0039]

The excrete deposit covering as claimed in the present

$$1 \text{ kg/cm}^2 = 0.98 \text{ bar}$$

$$\text{WEP} > 1 \text{ m WS} \quad [ < 20 \text{ m WS}]$$

invention is required to have a water resistant pressure of 0.1 kgf/cm<sup>2</sup> or more. Here, water resistant pressure refers to the value measured in compliance with method B of JIS L-1092. If the water resistant pressure is less than 0.1 kgf/cm<sup>2</sup>, rainwater and water droplets pass through the covering and reach the excreta deposit and prevent the object of covering by this covering from being achieved, thereby making this undesirable. A particularly preferable water resistant pressure is within the range of 0.7-20 kgf/cm<sup>2</sup>. If the water resistant pressure exceeds 20 kgf/cm<sup>2</sup>, both water vapor permeability and air permeability are lost, thereby making this undesirable.

[0040]

The excreta deposit covering as claimed in the present invention is required to have air permeability of 3000 seconds/100 cc or less. Here, air permeability refers to the value measured in compliance with JIS Z-1096. If the air permeability exceeds 3000 seconds/100 cc, air permeability becomes excessively large so that not only water vapor in the air but also water droplets become increasingly permeable, thereby making this undesirable. The lower limit of air permeability is 30 seconds/10 cc, and if air permeability is less than this level, since it becomes difficult for air to pass through the covering when used to cover excreta deposits, air inside the covering is depleted resulting in decreased activity of aerobic bacteria, thereby making this undesirable. A particularly preferable degree of air permeability is within the range of 50-2000 seconds/100 cc.

[0041]

#### 4. Use of the Covering

In order to cover excrete deposits with the covering as claimed in the present invention, the covering is placed over excrete deposits deposited according to conventional methods and covered to prevent the entrance of rainwater. Namely, the



covering should be placed over, for example, (1) excrete deposits deposited in a concrete frame constructed next to a barn, (2) excreta deposits deposited in a lagoon next to a barn, and (3) excreta deposits deposited in a large paddock. Furthermore, in order to uniformly ferment the excreta deposits or promote uniform drying of moisture, it is preferable to occasionally remove the covering and turn over the excreta deposits.

[0042] No forced aeration

Since an excreta deposit covering provided with the above-mentioned physical properties is water resistant and has satisfactory water vapor permeability and air permeability, although it allows adequate passage of water vapor that has evaporated from excreta deposits when the covering is used to cover excreta deposits, since it does not allow the passage of rainwater or water droplets, there is no runoff of juice from the excreta deposits, thereby making it possible to eliminate the problems of contamination or ground water as a result of juice flowing underground, contamination of rivers and lakes as a result of juice flowing into rivers and lakes, as well as eutrophication of rivers and lakes. In addition, since it is also possible to prevent the dissipation of the fermentation odor produced by excreta deposits, the problem of odor pollution can also be solved. Since water vapor and gas produced by fermentation of excreta deposits covered with the covering can be dissipated through pores in the covering while allowing air required for fermentation to enter through the pores in the covering, fermentation and aging can be promoted by occasionally turning over the excreta deposits. Fermented, aged and dried excreta deposits covered by the excreta deposit covering as claimed in the present invention can be applied as fertilizer for various vegetables, fruit vegetables, root vegetables, flowers and so forth.

[0043]

Strictly  
passive  
diffusion  
&  
turning  
of excreta  
for O<sub>2</sub>  
supply

[Examples]

Although the following provides a detailed explanation of the present invention based on its embodiments, the present invention is not limited to the examples described below provided they do not exceed its gist.

[0044]

<Production of Porous Polyolefin Film>

80 parts by weight of linear, low-density polyethylene {melt index (MI) = 1.0 g/10 min, flow ratio: 19, density ( $\rho$ ) = 0.921 g/cm<sup>3</sup>, copolymer component = 1-butene, amount of copolymerization = 10 wt%, melting point = 120°C, crushed to a powder able to pass through a 40 mesh sieve} and 80 parts by weight of ethylene-propylene copolymer {Japan Synthetic Rubber, EPO7, MI = 0.4 g/10 min,  $\rho$  = 0.86 g/cm<sup>3</sup>, crushed to a powder able to pass through a 40 mesh sieve} were mixed with a Henschell mixer. The MI of the resulting resin mixture was 0.8 g/10 min, and the density was 0.909 g/cm<sup>3</sup>.

[0045]

2.5 parts by weight of Tinuvin 622LD (hindered amine light stabilizer), 1.8 parts by weight of Cyasorb UV-531 (ultraviolet absorber), 1.5 parts by weight of zinc stearyl phosphate (acidic phosphate ester), 4 parts by weight of dioctylphthalate (plasticizer) and 0.024 parts by weight of 2,5-dimethyl-2,5-bis(t-butylperoxy)-3-hexane (radical generator) were respectively added to and mixed with this resin mixture while stirring followed by the addition of 200 parts by weight of calcium carbonate (mean particle size: 1.2  $\mu$ m, surface-treated with fatty acid) to obtain a raw material resin mixture. This mixture was then melted and kneaded with a double screw mixer (DSM, Nippon Seiko) to obtain pellets.

[0046]

Using these pellets as raw material, a film having a thickness

of 70  $\mu\text{m}$  was obtained by inflation molding using a 40 mm diameter extruding machine under conditions of cylinder temperatures of 170-190-210-230°C, head die temperature of 200°C, die diameter of 100 mm, pulling rate of 8 m/min, BUR = 3, frost line height = 700 mm and lay flat width = 471 mm. This film was slit in the direction of pulling followed by uniaxial orientation using a roller drawing machine under conditions of a drawing temperature = 60°C, drawing multiplying factor = 2.0 times and post-drawing rate = 11.0 m/min to obtain a porous polyethylene film having a thickness of 35  $\mu\text{m}$ .

ROUQUER-PARENT

4-15 g/m<sup>2</sup> @ 80% porosity  $\approx$  20-75  $\mu\text{m}$

[0047]

#### <Preparation of Porous Cloth and Laminate>

After selecting a Nylon-based, span-bonded non-woven cloth (fabric density: 15 g/m<sup>2</sup>) for the porous cloth, a hot melting resin was coated onto this non-woven cloth in a staggered pattern followed by lamination of the above-mentioned porous polyethylene film to obtain a laminate (covering) as claimed in the present invention. The water vapor permeability of this laminate as measured in compliance with JIS Z-0208 was 3800 g/m<sup>2</sup>-24 hours, and the air permeability as measured in compliance with JIS Z-1096 was 630 seconds/100 cc.

[0048]

#### <Excreta Deposit Covering Test 1>

A deposit of excreta having a high moisture content deposited in a paddock in a conical shape in the Kitami district of Hokkaido was covered with the above-mentioned laminate while a different deposit was not covered. The deposits were occasionally turned over and changes in moisture content, size of the deposit and other parameters of the deposits were measured. Those measurement results are shown in Table 1.

[0049]

[Table 1]

Table 1

	August 30	October 23
Moisture content	88.5%	52.2%
Size of deposit	80 m <sup>2</sup> x 0.6 m	32 m <sup>2</sup> x 1.5 m

[0050]

The following were determined from the results of covering test 1.

(1) The excreta deposit covered with the laminate prevented the entrance of rainwater from the outside and allowed evaporated water vapor to dissipate from the deposit. Consequently, there was no runoff of juice from the deposit, and drying of the surface of the deposit progressed which enabled the deposit to be piled up, thereby making it possible to reduce the deposit surface area.

(2) In contrast, although drying of the excreta deposit not covered with the laminate progressed when it was not raining, during rainfall, rainwater penetrated into the deposit causing the moisture content to increase and preventing the deposit surface area from being reduced.

[0051]

<Excreta Deposit Covering Test 2>

Two deposits (60 m<sup>2</sup> x 2 m) of bark compost deposited in a conical shape in the Kitami district of Hokkaido were prepared. One of the deposits was covered with the above-mentioned laminate, while the other deposit was not covered. Both deposits were occasionally turned over and analyzed for moisture content, pH, electrical conductivity {EC (millisiemens = ms)}, total carbon (T-C), total nitrogen (T-N) and other fertilizer components. Those results are shown in Table 2.

[0052]

[Table 2]

Table 2

Date	May 23	July 5		August 29	
Item	Raw material	Covered area	Non-covered	Covered area	Non-covered

			area		area
Moisture content (%)	66.6	55.7	47.4	51.6	52.4
pH	7.34	7.45	7.30	7.51	7.38
EC (ms)	2.91	3.57	4.09	3.89	3.83
T-C (%)	42.9	44.4	43.5	45.6	42.3
T-N (%)	1.75	1.77	2.07	2.01	2.21
C/N ratio	24	25	21	22	19
P <sub>2</sub> O <sub>5</sub> (%)	1.34	1.61	1.75	1.80	2.06
K <sub>2</sub> O (%)	1.00	1.32	1.55	1.61	1.59
CaO (%)	3.34	3.62	3.46	4.89	4.49
MgO (%)	0.62	0.69	0.76	0.77	0.84

[0053]

The following were determined from the results shown in Table 2.

(1) The moisture content of the excreta deposit covered with the laminate decreased over time, and since rainwater was unable to enter, this value did not increase.

(2) Since the salts in the excreta deposit covered with the laminate increased due to the progress of fermentation of the excreta deposit over time, the value of electrical conductivity (EC) gradually increased to a value higher than that of the non-covered area.

(3) The active ingredients of compost did not decrease in the excreta deposit covered with the laminate, and they were not washed away by rainwater.

[0054]

[Effect of the Invention]

As a result of demonstrating the particularly advantageous effects as described below, the present invention offers an extremely high level of industrial usefulness.

1. Since the water vapor permeability and air permeability of the excreta deposit covering as claimed in the present invention are both within a suitable range, although water vapor is dissipated from the excreta deposit, since rainwater is unable to enter, there is no runoff of juice from the excreta deposit,

thereby enabling it to solve problems of the prior art relating to environmental contamination such as contamination of rivers, lakes and ground water, caused by the juice of excreta deposits.

2. In the case of covering an excreta deposit with the excreta deposit covering as claimed in the present invention, since fermentation of the excreta deposit is promoted and rainwater is not allowed to enter, active ingredients when using as compost are not washed away, thereby allowing the obtaining of compost having a high utilization value.

[0055]

3. Since excreta deposits deposited in a paddock should be covered when using the excreta deposit covering as claimed in the present invention, it is extremely useful for drying excreta without having to fabricate a special structure or other equipment.

4. Since the excreta deposit covering as claimed in the present invention is a porous cloth or a laminate of a porous cloth and a porous polyolefin film, it has excellent strength.

Consequently, the covering is resistant to damage even when removed from the deposit or repeatedly performing the covering procedure to turn over the excreta deposit and therefore can be used for a long period of time. In the case of a laminate of a porous cloth and porous polyolefin film in particular, the combined addition of various types of resin additives to the polyolefin film is desirable since it allows the weather resistance of the covering to be significantly improved.

[ABSTRACT]

[Object] The object of the present invention is to provide a covering that is (1) able to cover a livestock excreta deposit deposited in a paddock and so forth and promote drying by preventing the entrance of rainwater, and (2) able to promote fermentation of lining materials such as rice straw contained in excreta deposits.

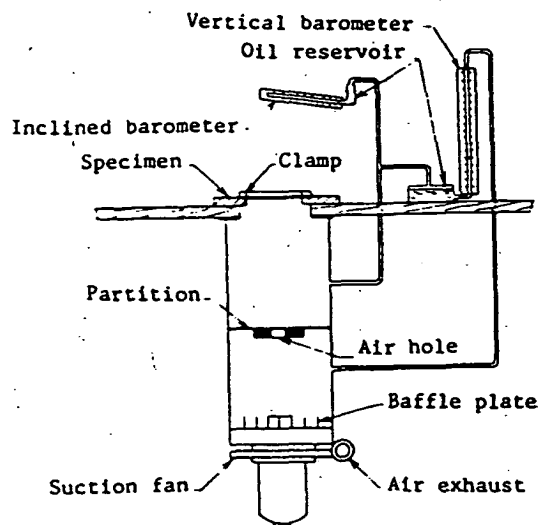
[Constitution] An excreta deposit covering that covers the surface of the excreta deposits of livestock deposited on the ground for drying and fermenting those excreta deposits comprising a porous cloth or a laminate of porous polyolefin film and porous cloth having water vapor permeability of  $1500 \text{ g/m}^2\text{-24}$  hours or more, water resistant pressure of  $0.1 \text{ kgf/cm}^2$  or more, and air permeability of 3000 seconds/100 cc or less.

[Effect] The above-mentioned object is achieved.

## 6.27 Air Permeability

6.27.1 Method A Using a Frazir type tester shown in Fig. 51, attach the specimen to one end of the cylinder, and adjust the suction fan with the rheostat so that the inclined barometer shows a pressure of 1.27 cm on water column. Obtain the air volume ( $\text{cm}^3/\text{cm}^2 \cdot \text{s}$ ) having passed through the specimen from the pressure indicated at the time by the vertical barometer and from the type of air hole used by the aid of the table attached to this tester. Measure the air volume, and express it to one place of decimals as average of five measurements.

Fig. 51. Frazir Type Tester



### 6.27.2 Method B This method applies mainly to wool fabrics.

Take five test specimens, each measuring  $5 \text{ cm} \times 5 \text{ cm}$ , from five different places of a sample, insert a specimen in the air spouting orifice (9 mm in diameter) of an air permeability tester shown in Fig. 52, and fasten it. Measure the time required for 300 ml of air to spout through the specimen under the pressure of 1.39 N (141.8 gf), and represent the air permeability by the use of the required time. Test three different places of each specimen, and express the required time to one place of decimals as average of the measurements made for five specimens.



Date 1999-12-06 SEARCH REPORT No P 2938/99

Title: Cover for contained aerobic treatment of biodegradable matter

Published available documentation from the following countries has been searched: SE, DK, NO, FI, GB, DE, CH, FR, EP, WO, AT, AU, CA, JP, RU and US (see enclosure).

The search has been performed in relevant parts of the following technical fields according to the International Patent Classification (IPC):

B32B, C05F

and in the US documentation in relevant parts of the following US-classes:  
Where appropriate, searches in databases are also performed.

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The following material is considered relevant.

**Patent documents:**

Ref	Country	No	Comments and indication of relevant passage etc.	Cat
1	JP	10203884		1
2	DE	4231414A1	Whole document	2
3	DE	29816749U1	The claims	2
4	JP	11130575		2
5	GB	1453883A1	The claims	2

**Coordinating engineer:** Hélène Erikson

Please note!

The Patent Office does not, in search reports, give any opinion on patentability, validity or infringement.

- \*) 1 = Document of particular relevance.  
2 = Documents defining the general state of the art.  
3 = Document cited for other reasons<sup>1</sup>

**Our examiners review 20 million documents from the following countries and organizations:**

<b>AUSTRALIA</b>	<b>FROM</b>	<b>1976</b>
<b>AUSTRIA</b>	<b>FROM</b>	<b>1971</b>
<b>CANADA</b>	<b>FROM</b>	<b>1976</b>
<b>DENMARK</b>	<b>FROM</b>	<b>1894</b>
<b>FINLAND</b>	<b>FROM</b>	<b>1944</b>
<b>FRANCE</b>	<b>FROM</b>	<b>1920</b>
<b>GERMANY</b>	<b>FROM</b>	<b>1895</b>
<b>GREAT BRITAIN</b>	<b>FROM</b>	<b>1855</b>
<b>JAPAN (Abstract in English)</b>	<b>FROM</b>	<b>1979</b>
<b>NORWAY</b>	<b>FROM</b>	<b>1886</b>
<b>SWEDEN</b>	<b>FROM</b>	<b>1885</b>
<b>SWITZERLAND</b>	<b>FROM</b>	<b>1927</b>
<b>U.S.A. (Classified acc. to USCL)</b>	<b>FROM</b>	<b>1898</b>
<b>U.S.S.R (Abstract in English)</b>	<b>FROM</b>	<b>1962</b>
<b>EPO</b>	<b>FROM</b>	<b>1978</b>
<b>PCT</b>	<b>FROM</b>	<b>1978</b>

**If necessary, the examiners also search databases containing technical information and patent information**

(C) WPI / DERWENT

AN - 1998-476617 [41]

AP - JP19970005729 19970116

PR - JP19970005729 19970116

TI - Covering for livestock excreta deposit - consists of porous cloth, or laminate of porous polyolefin film and the porous cloth, having specified permeability

IW - COVER LIVESTOCK EXCREMENT DEPOSIT CONSIST POROUS CLOTH LAMINATE POROUS POLYOLEFIN FILM POROUS CLOTH SPECIFIED PERMEABLE

PA - (MITU ) MITSUBISHI CHEM CORP

PN - JP10203884 A 19980804 DW199841 C05F3/06 008pp

IC - B32B5/24 ; B32B5/26 ; B32B7/02 ; B32B27/32 ; C05F3/06 ; D06N7/00

AB - J10203884 A covering material covers the surface of an livestock excreta deposit deposited on ground to dry and ferment the excreta deposit. The covering material consists of porous cloth, or a layered prod. of a porous polyolefin film and the porous cloth and has a water vapour permeability of 1500 g/m<sup>2</sup>-24 hours or more, a water resistant pressure of 0.1 kgf/cm<sup>2</sup> or more, and an air permeability of 3000 second/100 cc or less.

- USE - The covering material is used for drying and fermenting excreta discharged from livestock, including a milking cow, beef cattle, sheep, goat, horse, pig.
- ADVANTAGE - The covering material splashes vapour, yet accepts no rainwater. The result discharges no liq. from the excreta deposit. The fermentation of the excreta deposit is accelerated to use as compost. The covering material has superior strength, resulting in less damage, and allowing long-term use.
- (Dwg.0/0)